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Tracing Submarine hydrothermal Groundwater Discharge around Kueishantao off northeastern Taiwan using Radon

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Submarine groundwater discharge (SGD) is studied widely in the past two decades. Burnett (2003) had defined it as any and all flow of water on continental margins from the seabed to the coastal ocean, regardless of fluid composition or driving forces. Kueishantao (KST) is a young volcanic island located off northeastern Taiwan and at the southernmost part of the Okinawa Trough. Submarine hydrothermal systems are ubiquitous near the coast of KST, and in this study we are trying to trace the location of the hydrothermal vents adjacent to the islet from shallow (10 m) to deep (300 m) waters. The radioactive gas, Radon (222-Rn), is one of the most extensively used naturally occurring tracers for SGD since it is enriched in groundwater relative to seawater, easier to measure by RAD7, and it is not bioavailable. In this study, not only the radon distribution in surface seawater was conducted around the islet, but also accomplished chirp sonar and multi-beam investigations by using Ocean Researcher 2-1792 cruise in May 2010. Most of hydrothermal vents that we identified via chirp sonar profiles located at shallow waters with about 20m water depths, radon activity also reveal higher values around 0.004-0.006 Bq/L. However, the highest radon activity (0.009 Bq/L) was located offshore eastern KST where the water depth larger 200 meters. Although there's no chirp sonar data at this location, the feature of the sea bottom which derived from the multi-beam data showed a clear depression landform which might relate to the hydrothermal activity. From a simply back-of-the-envelope calculation, the activity of radon on the sea bottom is at the same order of magnitude with the hot spring water in North Taiwan. In contrast, the activity of radon at the hydrothermal vent in shallow waters near the KST on May 15, 2010 is much lower. It implies there are two different types of submarine hydrothermal systems in the study area. The hydrothermal SGD in the shallow waters which near the KST might be originated from the recirculated seawater and the system at deep waters might be rose from deeper sources.